

Claims

- 1.(original) Low expansion transparent glass-ceramics obtained by heat treating a base glass produced at a melting temperature of 1530°C or below, said glass-ceramics containing β -quartz or β -quartz solid solution as a predominant crystal phase and 50% - 60% SiO_2 in mass % on the basis of amount of total oxides, being free of K_2O and Na_2O , having an average linear thermal expansion coefficient (α) within a range from $+6 \times 10^{-7}/^\circ\text{C}$ to $+35 \times 10^{-7}/^\circ\text{C}$ within a temperature range from 100°C to 300°C and having 80% transmittance wavelength (T_{80}) of 700nm or below.
2. (original)Low expansion transparent glass-ceramics as defined in claim 1 wherein internal transmittance for a plate having thickness of 10mm is 75% or over at light wavelength of 1550nm.
3. (original)Low expansion transparent glass-ceramics as defined in claim 1 having a heat resisting temperature of 800°C or over.
4. (original)Low expansion transparent glass-ceramics as defined in claim 1 having Young's modulus of 90 GPa or over.
5. (original)Low expansion transparent glass-ceramics as defined in claim 1 containing 1.5% - 3.5% Li_2O in mass % on the basis of amount of total oxides.
6. (original)Low expansion transparent glass-ceramics as defined in claim 1 wherein amount of eluting lithium ion is less than $0.0050\mu\text{g}/\text{cm}^2$.
7. (original) Low expansion transparent glass-ceramics as defined in claim 1 containing 3% - 6% TiO_2 in mass % on the basis of amount of total oxides.
8. (original)Low expansion transparent glass-ceramics as defined in claim 1 containing three or more ingredients among RO ingredients (where R is Mg, Ca, Sr, Ba or Zn) in an amount of 0.5% or over in mass % on the basis of amount of total oxides for respective ingredients.

9. (original)Low expansion transparent glass-ceramics as defined in claim 8 containing ZnO in a larger amount than other RO ingredients in mass % on the basis of amount of total oxides.

10. (original)Low expansion transparent glass-ceramics as defined in claim 8 containing a total amount of the RO ingredients of 3.5% or over in mass % on the basis of amount of total oxides.

11. (original)Low expansion transparent glass-ceramics as defined in claim 1 containing a total amount of R'O ingredients (where R' is Mg, Ca, Ba or Sr) of 3% - 13% in mass % on the basis of amount of total oxides.

12. (original) Low expansion transparent glass-ceramics as defined in claim 1 comprising in mass % on the basis of amount of total oxides:

Al ₂ O ₃	20 - 30%
MgO	0.5 - 2%
CaO	0.5 - 2%
SrO	0 - 10%
BaO	1 - 5%
ZnO	0.5 - 15%
Li ₂ O	1.5 - 3.5%
TiO ₂	3 - 6%
ZrO ₂	1 - 5%
Nb ₂ O ₅	0 - 5%
La ₂ O ₃	0 - 5%
Y ₂ O ₃	0 - 5%
As ₂ O ₃ and/or Sb ₂ O ₃	0 - 2%.

13. (original)Low expansion transparent glass-ceramics obtained by heat treating a base glass produced at a melting temperature of 1530° or below, said glass-ceramics containing β-quartz or β-quartz solid solution as a predominant crystal phase and 50% - 60% SiO₂ in mass % on the basis of amount of total oxides and 1% - 5% BaO in mass % on the basis of amount of total oxides, having an average linear thermal expansion coefficient (α) within a range from

$+6 \times 10^{-7}/^{\circ}\text{C}$ to $+35 \times 10^{-7}/^{\circ}\text{C}$ within a temperature range from 100°C to 300°C and having 80% transmittance wavelength (T_{80}) of 700nm or below.

14.(original) Low expansion transparent glass-ceramics as defined in claim 13 wherein internal transmittance for a plate having thickness of 10mm is 75% or over at light wavelength of 1550nm.

15.(original) Low expansion transparent glass-ceramics as defined in claim 13 having a heat resisting temperature of 800°C or over.

16. original)Low expansion transparent glass-ceramics as defined in claim 13 having Young's modulus of 90 GPa or over.

17. (original) Low expansion transparent glass-ceramics as defined in claim 13 containing 1.5% - 3.5% Li_2O in mass % on the basis of amount of total oxides.

18.(original) Low expansion transparent glass-ceramics as defined in claim 13 wherein amount of eluting lithium ion is less than $0.0050\mu\text{g}/\text{cm}^2$.

19.(original) Low expansion transparent glass-ceramics as defined in claim 13 containing 3% - 6% TiO_2 in mass % on the basis of amount of total oxides.

20.(original) Low expansion transparent glass-ceramics as defined in claim 13 containing three or more ingredients among RO ingredients (where R is Mg, Ca, Sr, Ba or Zn) in an amount of 0.5% or over in mass % on the basis of amount of total oxides for respective ingredients.

21.(original) Low expansion transparent glass-ceramics as defined in claim 20 containing ZnO in a larger amount than other RO ingredients in mass % on the basis of amount of total oxides.

22. (original)Low expansion transparent glass-ceramics as defined in claim 20 containing a total amount of the RO ingredients of 3.5% or over in mass % on the basis of amount of total oxides.

23.(original) Low expansion transparent glass-ceramics as defined in claim 13 containing a total amount of R'O ingredients (where R' is Mg, Ca, Ba or Sr) of 3% - 13% in mass % on the basis of amount of total oxides.

24. (original)Low expansion transparent glass-ceramics as defined in claim 13 comprising in mass % on the basis of amount of total oxides:

Al ₂ O ₃	20 - 30%
MgO	0.5 - 2%
CaO	0.5 - 2%
SrO	0 - 10%
ZnO	0.5 - 15%
Li ₂ O	1.5 - 3.5%
TiO ₂	3 - 6%
ZrO ₂	1 - 5%
Nb ₂ O ₅	0 - 5%
La ₂ O ₃	0 - 5%
Y ₂ O ₃	0 - 5%
As ₂ O ₃ and/or Sb ₂ O ₃	0 - 2%.

25.(original) Low expansion transparent glass-ceramics obtained by heat treating a base glass produced at a melting temperature of 1530°C or below, said glass-ceramics containing 50% - 60% SiO₂ in mass % on the basis of amount of total oxides and 1.5% - 3.5% Li₂O on the basis of amount of total oxides, being free of K₂O and Na₂O, having an average linear thermal expansion coefficient (α) within a range from $+6 \times 10^{-7}/^{\circ}\text{C}$ to $+35 \times 10^{-7}/^{\circ}\text{C}$ within a temperature range from 100°C to 300°C and having 80% transmittance wavelength (T_{80}) of 700nm or below.

26. (original) Low expansion transparent glass-ceramics as defined in claim 25 wherein internal transmittance for a plate having thickness of 10mm is 75% or over at light wavelength of 1550nm.

27. (original) Low expansion transparent glass-ceramics as defined in claim 25 having a heat resisting temperature of 800°C or over.

28. (original) Low expansion transparent glass-ceramics as defined in claim 25 having Young's modulus of 90 GPa or over.

29. (original) Low expansion transparent glass-ceramics as defined in claim 25 wherein amount of eluting lithium ion is less than $0.0050\mu\text{g}/\text{cm}^2$.

30. (original) Low expansion transparent glass-ceramics as defined in claim 25 containing 3% - 6% TiO_2 in mass % on the basis of amount of total oxides.

31. (original) Low expansion transparent glass-ceramics as defined in claim 25 containing three or more ingredients among RO ingredients (where R is Mg, Ca, Sr, Ba or Zn) in an amount of 0.5% or over in mass % on the basis of amount of total oxides for respective ingredients.

32. Low expansion transparent glass-ceramics as defined in claim 31 containing ZnO in a larger amount than other RO ingredients in mass % on the basis of amount of total oxides.

33. (original) Low expansion transparent glass-ceramics as defined in claim 31 containing a total amount of the RO ingredients of 3.5% or over in mass % on the basis of amount of total oxides.

34.(original) Low expansion transparent glass-ceramics as defined in claim 25 containing a total amount of R' ingredients (where R' is Mg, Ca, Ba or Sr) of 3% - 13% in mass % on the basis of amount of total oxides.

35. (original) Low expansion transparent glass-ceramics as defined in claim 25 comprising in mass % on the basis of amount of total oxides:

Al_2O_3	20 - 30%
MgO	0.5 - 2%
CaO	0.5 - 2%
SrO	0 - 10%
BaO	1 - 5%
ZnO	0.5 - 15%

TiO ₂	3 - 6%
ZrO ₂	1 - 5%
Nb ₂ O ₅	0 - 5%
La ₂ O ₃	0 - 5%
Y ₂ O ₃	0 - 5%
As ₂ O ₃ and/or Sb ₂ O ₃	0 - 2%.

36. (original) Low expansion transparent glass-ceramics obtained by heat treating a base glass produced at a melting temperature of 1530°C or below, said glass-ceramics containing 50% - 60% SiO₂ in mass % on the basis of amount of total oxides, 1.5% - 3.5% Li₂O on the basis of amount of total oxides and 1% - 5% BaO in mass % on the basis of amount of total oxides, having an average linear thermal expansion coefficient (α) within a range from $+6 \times 10^{-7}/^{\circ}\text{C}$ to $+35 \times 10^{-7}/^{\circ}\text{C}$ within a temperature range from 100°C to 300°C and having 80% transmittance wavelength (T₈₀) of 700nm or below.

37. (original) Low expansion transparent glass-ceramics as defined in claim 36 wherein internal transmittance for a plate having thickness of 10mm is 75% or over at light wavelength of 1550nm.

38. (original) Low expansion transparent glass-ceramics as defined in claim 36 having a heat resisting temperature of 800°C or over.

39. (original) Low expansion transparent glass-ceramics as defined in claim 36 having Young's modulus of 90 GPa or over.

40. (original) Low expansion transparent glass-ceramics as defined in claim 36 wherein amount of eluting lithium ion is less than 0.0050 $\mu\text{g}/\text{cm}^2$.

41.(original) Low expansion transparent glass-ceramics as defined in claim 36 containing 3% - 6% TiO₂ in mass % on the basis of amount of total oxides.

42.(original) Low expansion transparent glass-ceramics as defined in claim 36 containing three or more ingredients among RO ingredients (where R is Mg, Ca, Sr, Ba or Zn) in an

amount of 0.5% or over in mass % on the basis of amount of total oxides for respective ingredients.

43. (original) Low expansion transparent glass-ceramics as defined in claim 42 containing ZnO in a larger amount than other RO ingredients in mass % on the basis of amount of total oxides.

44. (original) Low expansion transparent glass-ceramics as defined in claim 42 containing a total amount of the RO ingredients of 3.5% or over in mass % on the basis of amount of total oxides.

45. (original) Low expansion transparent glass-ceramics as defined in claim 36 containing a total amount of R'O ingredients (where R' is Mg, Ca, Ba or Sr) of 3% - 13% in mass % on the basis of amount of total oxides.

46. (original) Low expansion transparent glass-ceramics as defined in claim 36 comprising in mass % on the basis of amount of total oxides:

Al ₂ O ₃	20 - 30%
MgO	0.5 - 2%
CaO	0.5 - 2%
SrO	0 - 10%
ZnO	0.5 - 15%
TiO ₂	3 - 6%
ZrO ₂	1 - 5%
Nb ₂ O ₅	0 - 5%
La ₂ O ₃	0 - 5%
Y ₂ O ₃	0 - 5%
As ₂ O ₃ and/or Sb ₂ O ₃	0 - 2%.